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I. *Observations upon the Comet, that appear'd in the Months of October, November, and December, 1723. By the Reverend Mr. Bradley, M. A. Prof. Astron. Oxon. F. R. S.*

THE small Comet which was seen in these Parts of *Europe*, in the Months of *October*, *November*, and *December*, 1723. was first observed in *England* by *Dr. Halley*, on *Octob.* 9. between 7 and 8 of the Clock in the Evening; it appearing then to the naked Eye not much unlike a Star of the third Magnitude. Looking at it through a Telescope, he saw some small Telescopical Stars near it, whose Situation he noted together with the Comet's, in order to see which way it tended. About 9 he again viewed the Comet, and found it considerably moved from its former Station, having now passed a small Star, which at the time of the first Observation was on the other side of it. Comparing the two Situations of the Comet together, he perceived that its apparent Motion at that time was about 8 or 9 Minutes in an Hour, in a Direction towards *Sagitta*; and that the Comet passed very near, if it did not wholly eclipse the forementioned small Star, whose place he afterwards found to be in $\approx 7^{\circ} 22' 15''$ with $5^{\circ} 2'$ N. Latitude. From the Situation of the Comet at the time of the first Observation, he judged that it was in Conjunction with the Star at 8 *h.* 5'. equal Time. Note that the equal, and not the apparent, Time, is likewise made use of in all the following Observations.

The next Day he was pleased to communicate to me the Substance of what he had observed, whereby I was
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enabled, the Night following, to see the Comet at *Wansted*. The Clouds hindered me from observing it in the manner that I had designed ; but I had Time enough to measure its Distance (with a Micrometer in a Telescope of 7 Foot) from a Star in *Aquarius*, marked ϵ by *Bayer*. At 6 *b.* 21' the observed Distance between this Star and the Comet was $1^{\circ} 13' 53''$, and a great Circle passing through the Star and Comet, made an Angle with the Vertical Circle of $60^{\circ} \frac{1}{4}$. The Comet was more southerly and westerly than the Star. By this Observation the Comet preceded the Star in Right Ascension $1^{\circ} 3' 50''$ being $39' 5''$ more southerly; so that the Comet's Right Ascension was $307^{\circ} 6' 40''$ and its Declination $11^{\circ} 8' 15''$ S.

The Place of ϵ here assumed is according to the *British* Catalogue, as are also the Places of the other Stars hereafter mentioned from which the Comet was observed. The Right Ascensions and Declinations, which are here set down, of several small Stars that are not in that Catalogue, were determined by observing the Differences of Right Ascension and Declination between those small Stars and others that were in the Catalogue, and had nearly the same Declinations.

The same Evening, at 7 *b.* 3' a small Star that was more easterly than the Comet, and had about the same Declination with it, was distant from it $35' 40''$. About the same time another small Star that had nearly the same Right Ascension with the Comet, but was more southerly, was distant from it $39' 58''$. The Places of these two Stars I have not yet observed.

The next Night proved cloudy, so that I could not see the Comet again till *October* 12. when (the Air being very serene and clear) we had an Opportunity of comparing it with two or three small Stars that were near it ; my Uncle, the Reverend Mr. *Pound*, assisting

in this and most of the following Nights Observations.

At 7 *b.* 22' a small Star, whose Right Ascension was found $304^{\circ} 40' 23''$ and its Declination $7^{\circ} 8' 22''$ S. preceded the Comet in Right Ascension $26' 21''$ being $10' 42''$ more Northerly. Hence the Comet's Right Ascension was $305^{\circ} 6' 44''$ and its Declination $7^{\circ} 19' 4''$ S.

At 8 *b.* 50' the Comet was in the same Parallel of Declination with another small Star, whose Right Ascension was found $305^{\circ} 9' 56''$ and its Declination $7^{\circ} 13' 20''$ S. and preceded the said Star $6' 20''$ in Right Ascension. Hence the Right Ascension of the Comet was $305^{\circ} 3' 36''$ and its Declination $7^{\circ} 13' 20''$ S. These Observations were made with a Telescope of 15 Foot furnished with a Micrometer, as were also all those of the following Nights.

The next Night, *October* 13. 6 *b.* 58' the Comet followed a small Star, $4' 10''$ in Right Ascension, being more Northerly than the Star $11' 45''$. The Clouds did not permit us to observe the Place of this Star; but its Right Ascension must be about $304^{\circ} 22'$ and its Declination $6^{\circ} 10'$ S.

October 14. the Comet was near two Stars which are the 66th and 67th of *Aquila* and *Antinous* in the *British* Catalogue, and at 8 *b.* 57' it followed the south-ermost of them $20' 37''$ in Right Ascension. being $29' 8''$ more southerly. Hence the Comet's Right Ascension was $303^{\circ} 49' 10''$ and its Declination $4^{\circ} 43' 54''$ S.

October 15. 6 *b.* 35' the Comet preceded the northernmost of the said Stars $23' 6''$ in Right Ascension, being more southerly than the Star $4' 15''$. Hence the Right Ascension of the Comet was $303^{\circ} 24' 40''$. Its Declination $3^{\circ} 51' 3''$ S.

October 21. 6 *b.* 22' a small Star, whose Right Ascension was found $301^{\circ} 7' 17''$, and its Declination $0^{\circ} 11' 50''$ S. preceded the Comet $41' 6''$ in Right

Ascension, being $5' 50''$ more southerly. Hence the Comet's Right Ascension was $301^{\circ} 48' 23''$ and its Declination $0^{\circ} 6' 0''$ S.

October 22, 6 h. $24'$ a small Star, whose Right Ascension was found $301^{\circ} 39' 47''$ and its Declination $0^{\circ} 32' 43''$ N. followed the Comet $\frac{1}{2}$ a Minute in Right Ascension, being $13' 43''$ more northerly. Hence the Comet's Right Ascension, was $301^{\circ} 39' 17''$ and its Declination $0^{\circ} 19' 0''$ N.

October 24, 8 h. $2'$ a small Star whose Right Ascension was found $301^{\circ} 24' 57''$ and its Declination $1^{\circ} 9' 22''$ N. preceded the Comet $0' 37''$ in Right Ascension, being $5' 12''$ more Northerly. Hence the Comet's Right Ascension was $301^{\circ} 25' 34''$; and its Declination $1^{\circ} 4' 10''$ N.

October 29, 8 h. $55'$ a small Star whose Right Ascension was found $301^{\circ} 6' 20''$ and its Declination $2^{\circ} 51' 0''$ N. preceded the Comet one Minute in Right Ascension, being $23' 40''$ more Northerly. Hence the Comet's Right Ascension was $301^{\circ} 7' 20''$ and its Declination $2^{\circ} 27' 20''$ N.

October 30, 6 h. $20'$. The same Star had exactly the same Right Ascension with the Comet, being $11' 33''$ more Northerly. Hence the Comet's Right Ascension was $301^{\circ} 6' 20''$ and its Declination $2^{\circ} 39' 27''$ N.

November 5, 5 h. $53'$ a small Star whose Right Ascension was found $300^{\circ} 35' 00''$ and its Declination $3^{\circ} 45' 30''$ N. preceded the Comet $33' 0''$ in Right Ascension, being $2' 8''$ more Southerly. Hence the Comet's Right Ascension was $301^{\circ} 8' 0''$ and its Declination $3^{\circ} 47' 38''$ N.

November 8, 7 h. $6'$ a bright Star (placed by *Hevelius* in *Rostro Aquilæ*, but not inserted in the *British Catalogue*) whose Right Ascension at this time was found

found $302^{\circ} 21' 30''$ and its Declination $4^{\circ} 28' 40''$ N. followed the Comet $1^{\circ} 7' 40''$ in Right Ascension, being $13' 3''$ more Northerly. Hence the Comet's Right Ascension was $301^{\circ} 13' 50''$ and its Declination $4^{\circ} 15' 37''$ N.

November 14, 6 h. $20'$ a Star, whose Right Ascension was found $301^{\circ} 27' 10''$ and its Declination $4^{\circ} 59' 40''$ N. preceded the Comet $5' 35''$ in Right Ascension, being $5' 50''$ more Southerly. Hence the Comet's Right Ascension was $301^{\circ} 32' 45''$ and its Declination $5^{\circ} 5' 30''$ N.

This was the last Time that I observed the Place of the Comet 'till after the Full Moon ; my Affairs calling me to *Oxford*, where I had no Convenience for making such Observations.

Dr. Halley and *Mr. Graham* continued to observe the Comet 'till *November 20* ; and according to both their Observations that Evening at $7 h. 45'$ the Comet followed β in *Collo Aquila* $6^{\circ} 33' 55''$ in Right Ascension, being about $4'$ more Northerly than the Star. Hence the Comet's Right Ascension was $301^{\circ} 59' 50''$ and its Declination $5^{\circ} 48' 55''$ N.

The Light of the Moon daily increasing, prevented them from making any more Observations, the Comet being by this time grown so faint, as to become in a manner imperceptible while the Moon shone bright. And the faint Appearance which it made before the Moon obstructed the Sight of it, gave little Hopes of its being to be seen again after the Full Moon. Notwithstanding which on *December 3*. (being then near *Cirencester* in *Glocestershire*) I was tempted by the Serenity of the Evening, and the Use of a very good Telescope of 10 Foot, to look for it again before the Moon rose ; and I found it among some small Telefcopical Stars ; but it appear'd

so faint and dull, as made it doubtful, whether what I took for the Comet might not be a small Star with a little Hazinefs about it. But this Doubt was cleared two Nights after ; when I perceived that the Comet was moved from its former Situation, towards a bright Telescopical Star, from which I afterwards took its Difference of Right Ascension and Declination, upon my Return to *Wansted*, on Dec. 7. This Star's Right Ascension was then found $303^{\circ} 39' 20''$ and its Declination $7^{\circ} 32' 30''$ N. And Decemb. 7. 6 h. 45' the Comet followed it $3' 15''$ in Right Ascension, being $14'$ more Northerly than the Star. Hence the Comet's Right Ascension was $303^{\circ} 42' 35''$ and its Declination $7^{\circ} 46' 30''$ N.

This was the last Night that I saw the Comet, tho' I believe I might have continued to have observed it, had not an interrupted Succession of cloudy Evenings prevented so long, that it became uncertain where to look for it.

The forementioned Observations are the Principal of all that were made at *Wansted*; and most of them being taken from Stars which are not in the *British* Catalogue, whose Places therefore are here determined, only by comparing them with some that were ; it cannot be supposed that the Comet's Places deduced from them are altogether exact. For which Reason I have all along set down, not only the Place of the Comet and Star where it was known, but also the Particulars of the Observation, that if any hereafter should be willing to examine the Tract of this Comet more nicely, they may know where to find the Stars from which it was observed. The Places of the Stars here set down are abundantly sufficient for that Purpose, as will appear from the following Table, which contains the Longitudes and Latitudes of
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the Comet deduced from the foregoing Observations, together with the Places of the Comet calculated from the Theory of Gravity, for the Times of Observation on the several Days therein mentioned, as also the Differences between the Observed and Computed Places. Those Differences not exceeding one Minute, shew that the Observations are not only consonant to each other, but that the Places of the Stars are likewise near the Truth, since the Comets Places deduced from them are found all along to agree sufficiently near with the Theory of Gravity; the Truth of which having long since been established by its great Author Sir *Isaac Newton*, and my worthy Colleague Dr. *Halley*, needs not the Confirmation of so short a Series of Observations as was made of this Comet. But short as it is, I presume 'twill be no easy Matter to account for the Observations with the same Degree of Exactness any other way, than by that Theory, according to which the following Computations are made.

1723. Temp. Æquat.	Comet. Long. Observat.			Lat. Bor. Observ.			Comet. Long. Comput.			Lat. Bor. Comput.			Differ. Long.	Differ. Latit.
D. H. I.	O	I	II	O	I	II	O	I	II	O	I	II	"	"
<i>Octob.</i> 9 8 5	7	22	15	5	2	0	7	21	26	5	2	47	+ 49	- 47
10 6 21	6	41	12	7	44	13	6	41	42	7	43	18	- 30	+ 55
12 7 22	5	39	58	11	55	0	5	40	19	11	54	55	- 21	+ 5
14 8 57	4	59	49	14	43	50	5	0	37	14	44	1	- 48	- 11
15 6 35	4	47	41	15	40	51	4	47	45	15	40	55	- 4	- 4
21 6 22	4	2	32	19	41	49	4	2	21	19	42	3	+ 11	- 14
22 6 24	3	59	20	8	12		3	59	10	20	8	17	- 8	- 5
24 8 2	3	55	29	20	55	18	3	55	11	20	55	9	+ 18	+ 9
29 8 56	3	56	17	22	20	27	3	56	42	22	20	10	- 25	+ 17
30 6 20	3	58	9	22	32	28	3	58	17	22	32	12	- 8	+ 16
<i>Nov.</i> 5 5 53	4	16	30	23	38	33	4	16	23	23	38	7	+ 7	+ 26
8 7 6	4	29	36	24	4	30	4	29	54	24	4	40	- 18	- 10
14 6 20	5	2	16	24	48	46	5	2	51	24	48	16	- 35	+ 30
20 7 45	5	42	20	25	24	45	5	43	13	25	25	17	- 53	- 32
<i>Dec.</i> 7 6 45	8	4	13	26	54	18	8	3	55	26	53	42	+ 18	+ 36

In order to determine the Orbit of this Comet, I supposed it to describe a *Parabola* agreeable to what is delivered in the third Book of Sir *Isaac Newton's Princip. Math.* and then I found the Inclination of the Plains of the Orbit and Ecliptick $49^{\circ} 59'$. The Place of the Ascending Node $\gamma 14^{\circ} 16'$. The Place of the Perihelion $\delta 12^{\circ} 52' 20''$. The Distance of the Perihelion from the Node $28^{\circ} 36' 20''$. The Logarithm of the Perihelion distance 9.999414. The Logarithm of the Diurnal Motion 9.961007. The Time of the Comets being in its Perihelion, *Sept. 16. 16^h 10' equal Time. In its Orbit thus situated, the Motion of the Comet was Retrograde or contrary to the Order of the Signs.*

From these Elements, by the Help of Dr. *Halley's* general Table for Comets (to which they are adapted) I computed the Places in the forgoing Table; which agreeing with the observ'd Places as near as the Observations themselves agree with one another, shew that it would be a vain Attempt to pretend to determine the true Ellipse in which this Comet moves, or its Periodical Revolution, from so small a Part of its Orbit as that was, which it described between the first and last of the forgoing Observations; this therefore must be left to Posterity, especially since it is certain, that this Comet is not one of those of which Observations have hitherto been transmitted to us, sufficient to determine the Situation of their Orbits.

The *Nucleus* of this Comet was very little, for it appear'd but of a small Diameter when I first saw it, although it was then above three times nearer to the Earth, than the Sun is at its mean Distance. Its Tail was then hardly discernable with the naked Eye, but through a Telescope one might perceive a faint Light extending itself above a Degree from the Body.

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I have not yet heard that this Comet was seen before *October* 6. although it was in a proper Situation to have been observed in the Morning, most part of *September*, especially from the Time it was in its Perihelion, 'till near the End of that Month. For about that Time it crossed the Milky-way between the Mast of the Ship and the Head of the great Dog, passing between the bright Stars in the Body and Tail of the great Dog, towards the Head of the Dove, where it was about *September* 29. being by that time got so far towards the South-Pole, as not to rise above our Horizon. From thence it passed under the Tail of *Xiphius* within about 15° of the South Pole of the Ecliptick; and moving on between the Head of *Hydrus* and the bright Star in *Eridanus* called *Acarnar*, it went by the Stars in the Body and Neck of the Crane about *October* 5. when it came again above our Horizon. From hence passing under the Tail of the Southern Fish, and between the Stars in the Shoulder of *Capricorn*, it crossed the Ecliptick, *October* 8. in about $8^{\circ} \frac{1}{2}$ of *Aquarius*. From thence it moved on by the Hands of *Aquarius* and *Antinous* towards the Head of the *Eagle*, according to its Course before described.

The Comet was in Opposition to the Sun *Octob.* 1. when it had near 74° Southern Latitude, and alter'd its Longitude two Signs in a Day. About *October* 3. it was in its Perigæon, or nearest Distance to the Earth, being then almost ten times nearer to it than the Sun is at its mean Distance; and its apparent Motion was then about 20° in a Day, and when I last saw it, 'twas above twice as far off as the Sun.